

DURATION OF COPULATION IN
POANES HOBOMOK
(LEPIDOPTERA: HESPERIIDAE)
AND SOME BROADER SPECULATIONS*

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Many aspects of diurnal lepidopteran reproductive biology are still poorly known. Duration of copulation—an awkward phrase which, for convenience, is here symbolized T_f —can readily be determined in various species but rarely has been. It is of interest not only as a behavioral element of possible taxonomic value but also as a highly critical time in the life cycle: copulation is, of course, required for insemination; but copulating individuals, being mutually occupied and encumbered, must often be more vulnerable to predation than separate ones are. Since the act of copulation is vital for contributing genetic material to the succeeding generation but is not performed without risk, one may ask, What fraction of adult life is, on an average, spent copulating? Answers depend on knowing such attributes as T_f and mating frequency, as well as adult longevity for each sex.

Progress has recently been made in gathering comparative data on mating frequency by counting spermatophores dissected from reproductive tracts of wild females and in interpreting these data (Burns 1966, 1968; Shields 1968; Pliske, in prep.). On the other hand, T_f has received scant attention. Scattered observations include the following. An interspecific copulation involving pierid butterflies, *Colias interior* ♂ \times *C. eurytheme* ♀, lasted 67 minutes (Ae 1956). Among crosses of *C. eurytheme* carried out to study the genetics of an intricate enzyme polymorphism (Burns and Johnson 1967), the two that were timed gave T_f s of 55 and 75 minutes. In *Danaus plexippus*, a nymphalid butterfly, "It is not known for what length of time the male and female remain . . . united, but on one occasion such a pair was found an hour and a half later on the same tree and in the same position" (Urquhart 1960). A related species, *D. gilippus*, copulates for a period of about one to (usually) several hours (Brower, Brower and Cranston 1965). Indeed, timed copula-

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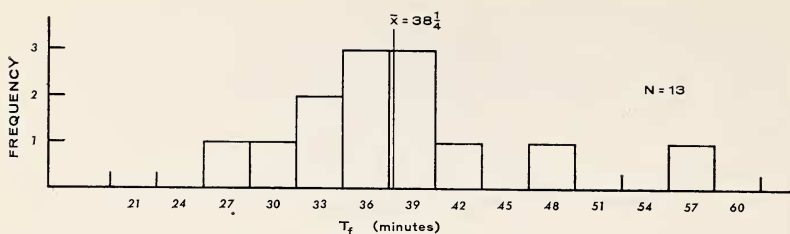


Fig.1. Frequency distribution of T_f in *Poanes hobomok*.

tions in this species have ranged from a low of 100 minutes to a high of 12 (± 3) hours (T. E. Pliske, personal communication). A pyrgine skipper butterfly, *Erynnis tristis*, copulated for a little less than one hour (Shields 1968).

Data reported below were obtained in the course of genetically analyzing sex-limited wing-color dimorphism in a hesperiine skipper, *Poanes hobomok* (Burns, unpublished). All material used in this work came from southern New England: Rockfall and Portland, Middlesex County, Connecticut; vicinity of Mt. Tom, north of Holyoke, Hampden County, Massachusetts; and Jacksonville, Windham County, Vermont. Although, in nature, *P. hobomok* is univoltine and spring-flying, a second generation was forced in late summer by laboratory rearing. On sunny days in August and September at Middletown, Connecticut, reared virgins were placed in outdoor screen cages, large enough (60" long \times 28" wide \times 39" high) to permit flight, and were continuously watched. Copulations were timed from beginning to end, with the result shown in Table 1.

The T_f s are normally distributed around a mean of 38 $\frac{1}{4}$ minutes (fig. 1). In view of their considerable length, the T_f s are remarkably consistent.

Males of *P. hobomok* are monomorphic but females are dimorphic: one female morph (light) is similar in facies to the male whereas the other (dark) is not. Seven experimental crosses involved light females and six, dark ones. Female color-pattern did not significantly affect T_f . Nor did the time of summer at which crosses occurred, later crosses not being significantly longer than earlier ones.

In general, T_f , like so many behavioral phenomena, is best approached statistically, with due regard, however, for prevailing weather conditions. Casual observations suggest that cloudiness and lower temperatures tend to prolong T_f , which is not surprising. Presumably it cannot be shortened indefinitely because of the logistics of spermatophore production.

Taken together, the meager data assembled here from four unrelated genera suggest, first, that T_f will tend to be a normally distributed variable (in any particular species population and under similar environmental conditions); and, second, that it will vary widely from some groups of species to others. In the series *Poanes* : *Erynnis* : *Colias* : *Danaus*, mean T_f s run a gamut from 38 minutes to nearly one hour to roughly 66 minutes to several hours.

The excessively long T_f of *D. gilippus* may relate to the fact that individuals of this species are often distasteful to vertebrate predators that can learn to leave them alone. Similarly, it may be on this account that danaines can afford to mate so very many times (see Burns 1968; Pliske, in prep.). But inedibility does not explain *why* they mate so long or so much. Although it has been suggested that the high number of matings may partly derive from increased longevity conferred by distastefulness (Pliske, in prep.), far more than this must be involved because danaines will mate several times in what, for a butterfly, can only be considered rapid succession. For example, three pairs of *D. plexippus* in separate small outdoor cages at San Antonio, Texas, were seen to mate once or (usually) twice each day over a four-day period (R. O. Kendall, personal communication). The question remains open. A correlation noted, in *D. gilippus*, between high mating frequency and a low population density associated with great mobility (Burns 1968) hints at directions for future inquiry.

Until we have hard longevity data for these relatively long-lived danaine butterflies, we cannot be precise about the proportion of

Table 1. Duration of copulation in 13 crosses of *Poanes hobomok*.

Cross No.	Date of Cross	Female Morph	T_f (min.)
63×A	VIII-20-1963	dark	38
63×B	VIII-21-1963	light	39
63×C	VIII-22-1963	dark	37 1/2
63×D	VIII-23-1963	dark	38 1/4
63×E	VIII-23-1963	dark	27 1/2
63×F	VIII-23-1963	light	30
63×G	VIII-28-1963	light	56
63×H	IX- 1-1963	light	36 1/2
63×I	IX- 3-1963	light	49
64×A	VIII-18-1964	light	37
64×B	VIII-24-1964	dark	41
64×C	VIII-27-1964	dark	34 1/2
64×E	IX- 2-1964	light	32

adult life actually given over to copulating. Unfortunately, data on longevity in the field are more laboriously got than are those on mating frequency and T_f . Yet *all* this information, from a variety of diurnal Lepidoptera, is needed for sound comparative analysis of evolutionarily critical features of reproductive biology.

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